ADDRESSING CRITICISMS OF THE TREATMENT OF NATURAL RESOURCES AND THE ENVIRONMENT

The current treatment of natural resources and the environment within the framework of the asset and production boundaries of the accounts has been criticized as misleading. Three general kinds of revisions are possible to address the perceived problems. The first would expand the set of goods treated as national assets to include valuable--but now uncounted--environmental and natural resources. In the parlance of the national accounts, this is *expanding the asset boundary*. The second kind of revision would expand the set of goods and services included in the measure of national income to encompass final services flowing from the environment and the nation's natural resources that are now unacknowledged (*expanding the production boundary*). The third kind of revision would reclassify some of the economic activities measured in the accounts by (1) identifying activities that counteract or protect against deteriorating environmental conditions and (2) identifying the contribution of the waste disposal services of the environment to income. This kind of revision to the accounts is called *reorganizing the production boundary*. These types of revisions fall under the rubric of green accounting because they more clearly identify the links between nature and the economy in the accounts.

Expanding the Asset Boundary

Expanding the asset boundary to record changes in natural resources and the environment implies that values for depletion and degradation would be computed for these natural capital assets, along with capital consumption for tangible reproducible capital. For conventional GDP (that is, using the current production boundary), the asset boundary would have to be expanded to include factor services generated by natural capital (see Table 3 on page 24). That is, values for depletion and degradation could be estimated for natural assets such as forests, mineral reserves, and the quality and quantity of agricultural lands. Values for degradation could also be calculated for changes in the environment's waste disposal services that are available without exceeding ambient quality standards as set by regulation. Of course, changing the production boundary would imply a different set of services as a basis for valuing capital assets.

If capital consumption for the expanded set of assets were subtracted from GDP, the results could be used to produce what might be termed an environmentally adjusted NDP measure. That is, environmentally adjusted

TABLE 2. CURRENT ASSET AND PRODUCTION BOUNDARIES IN THE NATIONAL ACCOUNTS

Type of Asset	Asset Boundary: Category of Service Flow		
	Marketed Factor Services[a]	Nonmarketed Factor Services[b]	Nonmarketed Final Services[c]
	Reproducible Capital		
Tangible, Privately Owned	Services of business-owned plant and equipment to industry and commerce	Major service flows not identifiable	Owner-occupied housing
			Services of business-owned capital
Tangible, Publicly Owned	Services paid for through user fees	Factor services of infrastructure to industry and commerce	Services of infrastructure to households
Human	Services of labor paid for by wages and salaries	Volunteer services	Other nonpecuniary services of education
	Natural Capital		
Environmental	Marketable permits for use of the waste disposal services of the environment	Waste disposal and other services of air, land, and water	Effects on health, aesthetics
Renewable Natural Resource	Food, lumber, water, and recreation paid for by user fees	Major service flows not identifiable	Other recreation services, biodiversity, nonuse benefits
Nonrenewable Natural Resource	Energy, minerals, water, and recreation paid for by user fees	Major service flows not identifiable	Recreation services, nonuse benefits

(Continued)

SOURCE: Congressional Budget Office.

NOTE: Shaded services not included in boundaries.

TABLE 2. CONTINUED

Type of Asset	Production Boundary: Category of Service Flow		
	Marketed Factor Services[a]	Nonmarketed Factor Services[b]	Nonmarketed Final Services[c]
	Reproducible Capital		
Tangible, Privately Owned	Services of business-owned plant and equipment to industry and commerce	Major service flows not identifiable	Owner-occupied housing
			Services of business-owned capital
Tangible, Publicly Owned	Services paid for through user fees	Factor services of infrastructure to industry and commerce	Services of infrastructure to households
Human	Services of labor paid for by wages and salaries	Volunteer services	Other nonpecuniary services of education
	Natural Capital		
Environmental	Marketable permits for use of the waste disposal services of the environment	Waste disposal and other services of air, land, and water	Effects on health, aesthetics
Renewable Natural Resource	Food, lumber, water, and recreation paid for by user fees	Major service flows not identifiable	Other recreation services, biodiversity, nonuse benefits
Nonrenewable Natural Resource	Energy, minerals, water, and recreation paid for by user fees	Major service flows not identifiable	Recreation services, nonuse benefits

a. Underground market activities are not included in gross domestic product (GDP) and are not represented Marketed factor services add value to GDP, which is recorded in the accounts.

b. The value added to GDP by nonmarketed factor services is not identified separately in the accounts.

c. Nonmarketed final services are not included in GDP except for housing, which is assigned an imputed value.

TABLE 3. EXPANDED ASSET AND CURRENT PRODUCTION BOUNDARIES FOR COMPUTING ENVIRONMENTALLY ADJUSTED NET DOMESTIC PRODUCT

Type of Asset	Expanded Asset Boundary: Category of Service Flow		
	Marketed Factor Services[a]	Nonmarketed Factor Services[b]	Nonmarketed Final Services[c]
	Reproducible Capital		
Tangible, Privately Owned	Services of business-owned plant and equipment to industry and commerce	Major service flows not identifiable	Owner-occupied housing
			Services of business-owned capital
Tangible, Publicly Owned	Services paid for through user fees	Factor services of infrastructure to industry and commerce	Services of infrastructure to households
Human	Services of labor paid for by wages and salaries	Volunteer services	Other non-pecuniary services of education
	Natural Capital		
Environmental	Marketable permits for use of the waste disposal services of the environment	Waste disposal and other services of air, land, and water	Effects on health, aesthetics
Renewable Natural Resource	Food, lumber, water, and recreation paid for by user fees	Major service flows not identifiable	Other recreation services, biodiversity, nonuse benefits
Nonrenewable Natural Resource	Energy, minerals, water, and recreation paid for by user fees	Major service flows not identifiable	Recreation services, nonuse benefits

(Continued)

SOURCE: Congressional Budget Office.

NOTE: Shaded services not included in boundaries.

TABLE 3. CONTINUED

Type of Asset	Current Production Boundary: Category of Service Flow		
	Marketed Factor Services[a]	Nonmarketed Factor Services[b]	Nonmarketed Final Services[c]
	Reproducible Capital		
Tangible, Privately Owned	Services of business-owned plant and equipment to industry and commerce	Major service flows not identifiable	Owner-occupied housing
			Services of business-owned capital
Tangible, Publicly Owned	Services paid for through user fees	Factor services of infrastructure to industry and commerce	Services of infrastructure to households
Human	Services of labor paid for by wages and salaries	Volunteer services	Other nonpecuniary services of education
	Natural Capital		
Environmental	Marketable permits for use of the waste disposal services of the environment	Waste disposal and other services of air, land, and water	Effects on health, aesthetics
Renewable Natural Resource	Food, lumber, water, and recreation paid for by user fees	Major service flows not identifiable	Other recreation services, biodiversity, nonuse benefits
Nonrenewable Natural Resource	Energy, minerals, water, and recreation paid for by user fees	Major service flows not identifiable	Recreation services, nonuse benefits

a. Underground market activities are not included in gross domestic product (GDP) and are not represented. Marketed factor services add value to GDP, which is recorded in the accounts.

b. The value added to GDP by nonmarketed factor services is not identified separately in the accounts.

c. Nonmarketed final services are not included in GDP except for housing, which is assigned an imputed value.

NDP would be modified for depreciation as a result of the use of tangible capital, depletion of natural resources, and degradation of environmental assets.

Changes in the value of tangible reproducible assets--whether from use, capital gains and losses, or investment--are currently recorded in the balance sheet. Similar types of entries could be made to account for changes in natural capital assets that occur over the accounting period. Resulting measures of depreciation from use (depletion and degradation) could be linked to the NIPA accounts to calculate an environmentally adjusted NDP.

Expanding the Production Boundary

Expanding the production boundary to include more services of natural resources and the environment would mean that broadened definitions of national income could be calculated. Measurement of a green GDP, for example, could count the final services of natural resources and the environment (see Table 4 on page 28). That is, the value of non-health-related services--recreation, biodiversity, aesthetic and nonuse benefits--as well as pollution damages (treated as health-related services that have been assigned negative values) would be included in national income.

Carrying out this kind of revision would require estimating imputed prices for final services of natural resources and the environment since they are not marketed. The product side of the accounts would record expenditures for marketed goods plus the imputed values for the set of final services of natural capital. The income side of the accounts would record payments to factors for their value added to both marketed and nonmarketed goods. In some cases the nonmarketed final services are difficult to evaluate because they are not related to the production process or to any market transaction. A lack of market data limits the choice of techniques for imputing a price for the assets generating these services.

Reorganizing Items Included in the Production Boundary

One way of reorganizing items that are included in the production boundary would be to identify service flows from the environment. This revision would recognize the flow of waste disposal services from the environment to businesses as a contribution to production. As is the case for other kinds of factor services in production, there is an associated return (income). Since waste disposal services are not marketed, a price would have to be assigned

to them on the basis of this factor's contribution to output. This information could be estimated by sector, recorded in the input-output tables, and used in analyzing the impacts of environmental policies. For example, the economic impact on production of an environmental policy changing allowable emission levels could then be traced through the I-O tables on an industry-by-industry level.

The identification of waste services is described as a reorganization rather than a redefinition of the production boundary, since it need not change GDP.[5] Instead, it would involve assigning some of the value added that is now recorded as profits, rents, and so forth to imputed factor payments for the environment. Under this revision, the product side of the accounts would not have to change; that is, expenditures would remain the same. The income side of the accounts--which records payments to factors--would be affected, however, since income would be reallocated among the factors of production. No one explicitly receives the return (factor payments) from the use of waste disposal services because there are virtually no established property rights for the services of the environment.[6] Since these factor payments are not paid out (as are wages), they are implicitly recorded as a part of profits or other factor income. (Some researchers suggest that the factor payments for use of the environment could be recorded separately in the accounts as a subsidy to producers who use these services.) Reorganizing the production boundary would, therefore, result in changes to the I-O table more than to other components of the accounts.

Many proponents of changing the accounts are concerned that gross domestic product is not a good measure of productive activity because it includes spending on pollution prevention. Some advocate circumventing this anomaly but subtracting so-called defensive expenditures from GDP. The production boundary would not change if this were done but GDP would decrease as a result of the reclassification of expenditures for restoring environmental degradation from final to intermediate.

The problem with this approach is that it also yields unexpected results. Countries that ignore pollution problems and spend money on other types of goods and services might appear to be better off than countries that spend money on preventing pollution. In addition, by taking expenditures on

5. Identifying the contribution to production of the waste disposal services of the environment would involve estimating a production relationship given the other factors of production. There are established methods of estimating returns on factors of production that may be applied in this circumstance.

6. The obvious exception is the ownership implied by the sale of marketable pollution permits.

TABLE 4. EXPANDED ASSET AND PRODUCTION BOUNDARIES FOR COMPUTING GREEN GROSS DOMESTIC PRODUCT AND ITS NET DOMESTIC PRODUCT

	GDP Asset Boundary: Category of Service Flow		
Type of Asset	Marketed Factor Services[a]	Nonmarketed Factor Services[b]	Nonmarketed Final Services[c]
	Reproducible Capital		
Tangible, Privately Owned	Services of business-owned plant and equipment to industry and commerce	Major service flows not identifiable	Owner-occupied housing
			Services of business-owned capital
Tangible, Publicly Owned	Services paid for through user fees	Factor services of infrastructure to industry and commerce	Services of infrastructure to households
Human	Services of labor paid for by wages and salaries	Volunteer services	Other nonpecuniary services of education
	Natural Capital		
Environmental	Marketable permits for use of the waste disposal services of the environment	Waste disposal and other services of air, land, and water	Effects on health, aesthetics
Renewable Natural Resource	Food, lumber, water, and recreation paid for by user fees	Major service flows not identifiable	Other recreation services, biodiversity, nonuse benefits
Nonrenewable Natural Resource	Energy, minerals, water, and recreation paid for by user fees	Major service flows not identifiable	Recreation services, nonuse benefits

(Continued)

SOURCE: Congressional Budget Office.

NOTE: Shaded services not included in boundaries.

TABLE 4. CONTINUED

Type of Asset	Production Boundary: Category of Service Flow		
	Marketed Factor Services[a]	Nonmarketed Factor Services[b]	Nonmarketed Final Services[c]
	Reproducible Capital		
Tangible, Privately Owned	Services of business-owned plant and equipment to industry and commerce	Major service flows not identifiable	Owner-occupied housing
			Services of business-owned capital
Tangible, Publicly Owned	Services paid for through user fees	Factor services of infrastructure to industry and commerce	Services of infrastructure to households
Human	Services of labor paid for by wages and salaries	Volunteer services	Other nonpecuniary services of education
	Natural Capital		
Environmental	Marketable permits for use of the waste disposal services of the environment	Waste disposal and other services of air, land, and water	Effects on health, aesthetics
Renewable Natural Resource	Food, lumber, water, and recreation paid for by user fees	Major service flows not identifiable	Other recreation services, biodiversity, nonuse benefits
Nonrenewable Natural Resource	Energy, minerals, water, and recreation paid for by user fees	Major service flows not identifiable	Recreation services, nonuse benefits

a. Underground market activities are not included in gross domestic product (GDP) and are not represented. Marketed factor services add value to GDP, which is recorded in the accounts.

b. The value added to GDP by nonmarketed factor services is not identified separately in the accounts.

c. Nonmarketed final services are not included in GDP except for housing, which is assigned an imputed value.

environmental protection out of GDP, the effects of increased environmental protection on jobs and incomes could not be as easily measured. The reason is that any relationship between expenditures on environmental protection and output or income would be removed from the accounts (conforming to the identity of income and expenditure).

Instead of subtracting expenditures on environmental protection, items included in the current production boundary could be reorganized to identify more clearly the costs of reducing the risks of pollution-caused damages to health. Reclassifying these items would mean that some of the expenditures now listed as investment and consumption would be listed as defensive expenditures. These would include expenses for ameliorating health problems related to the environment and for abatement equipment. Reclassifying these costs as a part of reorganizing the accounts would also help to identify the benefits and costs of changing emission levels at the industry level. This type of revision is also classified as a reorganization because it would not have to result in a change in the measure of national income.

USING THE NATIONAL ACCOUNTS TO MEASURE SUSTAINABLE INCOME

The desire that economic growth not be accomplished at the expense of environmental quality or an excessive depletion of natural resources has focused attention on the concept of sustainable development. The World Commission on Environment and Development (the Brundtland Commission) introduced the idea to policymakers in its seminal 1987 report, *Our Common Future*. The commission defined the concept as "meeting the needs of the present generation without compromising the needs of future generations."[7] It has proved difficult to carry out the concept of sustainability with any precision, however. Among the many definitions of sustainability, the notions of "weak" and "strong" sustainability provide a useful framework for analysis. Strong sustainability implies that natural resources should be preserved at levels consistent with some minimum ecological criteria. The notion suggests that no further substitution of one type of capital with another should be permitted beyond a certain point. Weak sustainability suggests that the total value of capital should be preserved where losses in one asset can be

7. There are problems with this general definition of sustainable development in that it implicitly assumes that the economy (and national government) meet(s) "needs" as opposed to "wants." For developed nations in particular, many would agree that these economies meet a lot of wants while failing to meet some important needs. The many interpretations of this general definition take on subjective valuations of "needs" versus "wants." Although there are problems with this definition, it remains the generally accepted broad basis from which more specific definitions are derived.

compensated for by gains in others. Incorporating natural resources and the environment into the accounts, in particular by expanding the asset boundary, implicitly adopts a framework in which trade-offs between different types of capital are possible. At any rate, the Brundtland Commission's general definition can and has been interpreted in many ways, including the notion that the assets of ecological systems must be kept physically intact, or that wealth (the total value of all assets) must not be allowed to decline.[8]

The general concept of sustainability originates in the study of nature, where predators are often observed avoiding the overexploitation of their supply of prey in order to ensure a sustained yield. In economics, the concept of income (introduced by John Hicks) serves as a guide for "prudent conduct" in deciding how much to consume from current monetary receipts.[9] Hicksian income is defined as the maximum amount that a person or organization can consume during a specific period and still have as much wealth at the end as at the beginning. It is based on the idea that if you liquidate your assets and use the proceeds for consumption, you are living beyond your means, and thereby undermining your ability to sustain your current standard of living. Hicksian income is increasingly referred to as sustainable income because it could be used to indicate whether the total value of a nation's assets are being maintained.[10]

Using the information in the national accounts to generate a measure of sustainable income is consistent with the idea of meeting present needs without compromising the needs of future generations. Sustainable income is calculated by adjusting GDP for the net change in the value of all assets that contribute to national wealth. Using the current production boundary to measure sustainable income would require accounting for changes in all forms of capital that generate factor services. This total measure could serve as an indicator of whether the economy was accumulating or expending wealth. Measuring sustainable income would help the accounts provide assessments of the nation's assets and national wealth.

One benefit of measuring sustainable income is that data necessary for such an effort would enhance the usefulness of the accounts for policy analysis. The more detailed information about the flow of goods and services

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8. Tom Tietenberg, *Environmental and Natural Resource Economics* (New York: Harper Collins Publishers, 1992), Chapter 20.

9. John Hicks, *Value and Capital* (London: Oxford Press, 1936).

10. S.E. Serafy and Ernst Lutz, "Environmental and Resource Accounting: An Overview," in Yusuf Ahmad, Salah El Serafy, and Ernst Lutz, eds., *Environmental Accounting for Sustainable Development* (Washington, D.C.: World Bank, 1989), p. 2.

from publicly owned and human capital in the I-O tables and balance sheets would be helpful in analyzing links between investments in education and transportation systems and the performance of the economy. Moreover, it would provide policymakers with a general measure of national wealth incorporating the effects of changes in international terms of trade. The benefits are, therefore, similar to those derived from the additional data needed to incorporate natural capital into the accounts; that is, helping to analyze the ties between environmental and natural resource policies and economic performance.

Understanding Sustainable Income

Gross domestic product, net domestic product, and sustainable income represent different ways of representing the nation's capital. GDP measures gross income but ignores the fact that a part of that income may be generated by drawing down capital assets. As currently measured in the accounts, NDP estimates the income remaining after adjusting for the change in the tangible capital stock caused by use and accidental loss (capital consumption). Sustainable income is the amount of income that would be left over after calculating the change in the full value (as it affects national wealth) of all assets. Calculating the changes in value of capital imparts additional information about national wealth. On an international basis, human capital makes an important contribution to sustainability. Hence, it is important that any treatment of sustainable income be truly comprehensive by accounting for the change in value of the full set of assets contributing to the economy. To do otherwise could bias the results because the value of these assets may move in different directions. A decrease in the value of natural assets could be more than offset by an increase in the value of reproducible assets. These implicit trade-offs are consistent with the notion of "weak" sustainability.

Net domestic product is not a good measure of sustainable income, for two reasons. First, as currently calculated, NDP is not adjusted for the depreciation of all forms of capital that contribute to final goods and services counted in GDP. Second, capital consumption does not measure the net change in the value of assets. Rather, it is an estimate of the loss of value caused by use and accidental loss. In some cases, with no change in prices, the two methods of calculating depreciation are equivalent.

A measure of sustainable income using the current definition of GDP would keep the production boundary unchanged but expand the asset boundary. The asset boundary would be expanded to include the discounted income from the factor service flows of tangible, publicly owned, human, and

natural capital. The reason for expanding the boundary would be to record changes in value for capital that provide factor service flows that are counted in the current measure of national income (see Table 5). Measuring the sustainability of conventional GDP requires that net changes in the value of all forms of capital be subtracted from GDP. This measure of sustainable income, although based on the current definition of GDP, would still be laborious because the value of nontraditional forms of capital (natural, human, and publicly owned) would have to be computed along with reproducible capital that is tangible and privately owned.

Measuring sustainable income on the basis of a green GDP would entail expanding the definition of GDP to include a "fair" market value for all current service flows from natural capital. Measuring the sustainability of this more broadly defined GDP requires that the changes in the value of capital in the accounts be based on changes in the future flows of all factor services from publicly owned tangible, reproducible, and human capital, and both the factor service and final flows of natural capital that are counted in the expanded measure of GDP (see Table 6). Thus, the flows from natural capital would have to include not only factor services, but health benefits, recreation services, and nonuse benefits, since the asset and production boundaries must coincide in order to measure sustainable income.

Measuring Sustainable Income

There are two important issues connected with deciding to measure sustainable income as a part of revising the accounts, namely whether one can justify the additional efforts required to (1) expand the asset boundary beyond natural resources and the environment and (2) compute a second (broader) measure of depreciation.

In order to obtain a consistent measure of sustainable income, one must measure the change in value of all assets in the asset boundary. One of the greatest challenges in the task of expanding the asset boundary to measure sustainable income is assessing value and the change in it for a broader set of assets. The difference between the change in value and capital consumption is approximately equivalent to the amount of capital gains and losses resulting from price changes in the economy.

The net change in the value of an asset is caused by physical changes in the stock--through use and accidental loss--and unanticipated changes in general market conditions. Improvements in technology, other changes in the production process (including capacity utilization), changes in market

TABLE 5. ASSET AND PRODUCTION BOUNDARIES FOR COMPUTING SUSTAINABLE INCOME BASED ON CONVENTIONAL GROSS DOMESTIC PRODUCT

	Expanded Asset Boundary: Category of Service Flow		
Type of Asset	Marketed Factor Services[a]	Nonmarketed Factor Services[b]	Nonmarketed Final Services[c]
	Reproducible Capital		
Tangible, Privately Owned	Services of business-owned plant and equipment to industry and commerce	Major service flows not identifiable	Owner-occupied housing
			Services of business-owned capital
Tangible, Publicly Owned	Services paid for through user fees	Factor services of infrastructure to industry and commerce	Services of infrastructure to households
Human	Services of labor paid for by wages and salaries	Volunteer services	Other nonpecuniary services of education
	Natural Capital		
Environmental	Marketable permits for use of the waste disposal services of the environment	Waste disposal and other services of air, land, and water	Effects on health, aesthetics
Renewable Natural Resource	Food, lumber, water, and recreation paid for by user fees	Major service flows not identifiable	Other recreation services, biodiversity, nonuse benefits
Nonrenewable Natural Resource	Energy, minerals, water, and recreation paid for by user fees	Major service flows not identifiable	Recreation services, nonuse benefits

(Continued)

SOURCE: Congressional Budget Office.

NOTE: Shaded services not included in boundaries.

TABLE 5. CONTINUED

Type of Asset	Current Production Boundary: Category of Service Flow		
	Marketed Factor Services[a]	Nonmarketed Factor Services[b]	Nonmarketed Final Services[c]
	Reproducible Capital		
Tangible, Privately Owned	Services of business-owned plant and equipment to industry and commerce	Major service flows not identifiable	Owner-occupied housing
			Services of business-owned capital
Tangible, Publicly Owned	Services paid for through user fees	Factor services of infrastructure to industry and commerce	Services of infrastructure to households
Human	Services of labor paid for by wages and salaries	Volunteer services	Other nonpecuniary services of education
	Natural Capital		
Environmental	Marketable permits for use of the waste disposal services of the environment	Waste disposal and other services of air, land, and water	Effects on health, aesthetics
Renewable Natural Resource	Food, lumber, water, and recreation paid for by user fees	Major service flows not identifiable	Other recreation services, biodiversity, nonuse benefits
Nonrenewable Natural Resource	Energy, minerals, water, and recreation paid for by user fees	Major service flows not identifiable	Recreation services, Non-use benefits

a. Underground market activities are not included in gross domestic product (GDP) and are not represented. Marketed factor services add value to GDP, which is recorded in the accounts.

b. The value added to GDP by nonmarketed factor services is not identified separately in the accounts.

c. Nonmarketed final services are not included in GDP except for housing, which is assigned an imputed value.

TABLE 6. EXPANDED ASSET AND PRODUCTION BOUNDARIES FOR COMPUTING SUSTAINABLE INCOME BASED ON GREEN GROSS DOMESTIC PRODUCT

	Expanded Asset Boundary: Category of Service Flow		
Type of Asset	Marketed Factor Services[a]	Nonmarketed Factor Services[b]	Nonmarketed Final Services[c]
	Reproducible Capital		
Tangible, Privately Owned	Services of business-owned plant and equipment to industry and commerce	Major service flows not identifiable	Owner-occupied housing
			Services of business-owned capital
Tangible, Publicly Owned	Services paid for through user fees	Factor services of infrastructure to industry and commerce	Services of infrastructure to households
Human	Services of labor paid for by wages and salaries	Volunteer services	Other nonpecuniary services of education
	Natural Capital		
Environmental	Marketable permits for use of the waste disposal services of the environment	Waste disposal and other services of air, land, and water	Effects on health, aesthetics
Renewable Natural Resource	Food, lumber, water, and recreation paid for by user fees	Major service flows not identifiable	Other recreation services, biodiversity, nonuse benefits
Nonrenewable Natural Resource	Energy, minerals, water, and recreation paid for by user fees	Major service flows not identifiable	Recreation services, nonuse benefits

(Continued)

SOURCE: Congressional Budget Office.

NOTE: Shaded services not included in boundaries.

TABLE 6. CONTINUED

Type of Asset	Expanded Production Boundary: Category of Service Flow		
	Marketed Factor Services[a]	Nonmarketed Factor Services[b]	Nonmarketed Final Services[c]
	Reproducible Capital		
Tangible, Privately Owned	Services of business-owned plant and equipment to industry and commerce	Major service flows not identifiable	Owner-occupied housing
			Services of business-owned capital
Tangible, Publicly Owned	Services paid for through user fees	Factor services of infrastructure to industry and commerce	Services of infrastructure to households
Human	Services of labor paid for by wages and salaries	Volunteer services	Other nonpecuniary services of education
	Natural Capital		
Environmental	Marketable permits for use of the waste disposal services of the environment	Waste disposal and other services of air, land, and water	Effects on health, aesthetics
Renewable Natural Resource	Food, lumber, water, and recreation paid for by user fees	Major service flows not identifiable	Other recreation services, biodiversity, nonuse benefits
Nonrenewable Natural Resource	Energy, minerals, water, and recreation paid for by user fees	Major service flows not identifiable	Recreation services, nonuse benefits

a. Underground market activities are not included in gross domestic product (GDP) and are not represented. Marketed factor services add value to GDP, which is recorded in the accounts.

b. The value added to GDP by nonmarketed factor services is not identified separately in the accounts.

c. Nonmarketed final services are not included in GDP except for housing, which is assigned an imputed value.

concentration, new discoveries, and changes in consumer tastes can all affect asset markets. When changes in market conditions affect prices and interest rates, the value of an asset can show capital gains (with a price increase) or losses (with a price decrease). In some cases, the physical quantity of assets may change only slightly but prices may fluctuate widely. Nevertheless, sustainable income must account for changes in the value of capital associated with its contribution of service flows to future GDP. This may necessitate the use of statistical smoothing methods to net out transitory capital gains and losses.

HOW DO WE PROCEED?

Green accounting is usually interpreted to mean adding more information about natural resources and the environment to the national accounts. If a decision is made to adopt some level of green accounting, the most immediate concern will be how to proceed with the three general types of revisions. Some or all of these approaches to revising the accounts could be applied. Should all three kinds be undertaken simultaneously or in sequence? Should the easiest aspects of each kind of revision be completed--either simultaneously or sequentially--before the more difficult are attempted?

These questions reflect a dilemma. The Bureau of Economic Analysis has for some time been working on measuring depletion of natural resources (oil, gas, and forests) and expenditures on abatement equipment. This activity is most applicable to the work of expanding the asset boundary to record changes in environmental quality and natural resource stocks and reorganizing the production boundary to identify more clearly the costs of avoiding damage by pollution. There are no estimates comparing the costs of these research activities.

Expanding the production boundary, however, will probably be more expensive and time-consuming than expanding the asset or reorganizing the production boundaries. Any expansion of the production boundary will require imputation of prices because the services that are included are not marketed. The nonmarketed final services, such as the benefits of recreation and biodiversity, are especially difficult to price because fewer techniques are available and because many would involve the assignment of value to human life. Environmental waste disposal services--which would have to be priced as part of a reorganization of the production boundary--are also nonmarketed services, but there is a greater variety of techniques for pricing them because they are inputs for the production of marketed outputs.

It might be argued that it is premature to work toward expanding the asset boundary to include natural assets in the accounts without first deciding exactly what should be in the production boundary. After all, the value of any capital stock in the accounts is based on the discounted returns from the future flow of goods and services included in GDP. A lack of agreement on the definition of GDP means that it is unclear what set of service flows to use as a basis for valuating the nation's assets. Nevertheless, any change from the current definition of GDP will probably expand, rather than contract, the types of goods and services counted. Data collected on the service flows from natural capital counted in current GDP are likely, therefore, to remain valuable, even if GDP is eventually redefined.

Efforts by the Bureau of Economic Analysis and the United Nations' Office of Statistics are consistent with expansion of the asset boundary and reorganization of the production boundary. This makes sense as a first step because many of the flows from natural resources are bought and sold in established markets. But the next step cannot be determined until the eventual goal is identified. In part, this will be a political decision but should be influenced by the degree of uncertainty concerning available data and methods of valuing stocks and flows.